

January 15, 2019

Mr. Christopher Grundler
USEPA Headquarters
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1200 Pennsylvania Ave. NW
MC6401A
Washington, DC 20460

Dear Mr. Grundler:

I hope you and your family had a wonderful holiday season, and that you are ready for a busy and productive 2019. It has been some time since we corresponded, and I promised that you would be hearing from me again.

As you know, I sincerely appreciated your March 15th, 2018 response to my letter of February 5th, 2018. After several unsatisfactory responses from your staff, you answered my question when you wrote "...it is important to note that the EPA estimates cited in the Wall Street Journal refer only to directly emitted PM. We agree that ambient levels of PM are a result of secondarily formed particles in addition to direct PM emissions and that light-duty gasoline vehicles are important sources of the precursors to PM formation".

[You will recall that the WSJ article cited 2014 EPA estimates that PM2.5 (fine particulate) emissions from off-road sources such as leaf blowers (43,442 tons) are nearly as much as light-duty vehicles (59,301 tons). Relying on EPA's data, the author misled the public and policymakers by saying that: "Overall, EPA figures show that the small, non-road engines contribute...1% of particulate matter, the same amount as passenger cars."]

In addition to correcting this misleading data, your letter stated that "We share your interests in reducing particulate matter (PM) and polycyclic aromatic hydrocarbons (PAHs)." That is the focus of my letter to you today.

You also responded to my questions about why EPA/OTAQ has not done its job in enforcing the mandatory Section 202(l) MSAT provision in the Clean Air Act. You said: "With respect to Clean Air Act section 202(l), the EPA has acted twice under this specific authority, including the February 2007 rule that addresses the aromatics content of gasoline through required limits on benzene...". You went on to say "While the EPA continues to look for opportunities to further reduce air toxics, as required by Clean Air Act Section 202(l), we must also consider technological feasibility and costs."

As you know, when Congress enacted the Section 202(l) provision, it made very clear that the non-benzene aromatic compounds (the "TEX" fraction) are not fully captured by vehicle emissions control systems. Everyone knows that the "TEX" fraction of gasoline BTEX is the primary source of tailpipe benzene emissions. In fact, HEI and other experts have confirmed that 50% or more of today's urban benzene inventories are attributable to the large aromatics fraction that exists in today's gasoline.

Unfortunately, as your letter admits, EPA's 2007 MSAT Final Rule focused only on benzene, and it required a miniscule reduction in benzene levels (from 1.0% to 0.6%) and did nothing to address the rest of the aromatic compounds.

That is why we continue to insist that EPA/OTAQ has not "done its jobs" in terms of reducing these lethal emissions, especially in traffic-congested urban areas where most of the nation's people live and work.

EPA Used Obsolete and Wildly Inaccurate Predicates In its 2007 MSAT Rule Cost – Benefit Analysis. EPA justified its decision to restrict its controls only to the benzene molecule by conducting a cost – benefit analysis that relied upon extremely obsolete and, in many cases, just plain wrong factual predicates. These included the use of 1993 EIA projections of \$19 oil, \$.85 gasoline, and perhaps most egregious, the assumption that two gallons of ethanol "octane-equivalent" are required to displace one gallon of toluene's "octane equivalent". As you know, the exact opposite is true.

However, there may a silver lining here. It appears as though you and I agree on one thing: EPA has a continuing obligation to reduce gasoline BTEX levels and MSAT emissions, including SOA-bound PAHs, as technologies present themselves.

EPA's 2007 MSAT Rule Left the Door Open to Revisiting Section 202(l). EPA Must Revisit Aromatics Control If Evidence "Supports a Role for Secondary PM2.5 Formation." We believe that your admission that gasoline exhaust contains "important sources of the precursors to PM formation" is a very big deal. We also believe that it is very timely, since your Agency is in the final stages of considering comments to the SAFE Rule

We commend you and your Agency for opening the door to long overdue enforcement of Section 202(l) in the pending SAFE Rule. For the first time, EPA requested comment on "whether and how it should require higher octane gasoline to be sold, consistent with Title II of the Clean Air Act". As you know, Section 202(l) is part of Title II.

The National Farmers Union, and a number of its state chapters—including mine—signed on to the Clean Fuels Development Coalition (CFDC) SAFE Rule comments, submitted October 26, 2018. I would respectfully direct your attention to p. 10 of those comments, and these words: "Aromatics/BTEX is not only the primary source of the most dangerous urban air toxics, but also the dominant source of PM2.5 secondary organic aerosols (SOAs), which carry the toxics long distances, and are major contributors to ground level ozone. In its 2011 report to Congress, EPA projected that by 2020, 85% of the \$2 trillion in savings from the 1990 CAA will come from reductions in ambient PM, and that its models under predict the amount of the fine and ultra-fine particulates that are caused by gasoline aromatics/BTEX."

On the one hand, your letter appears to have conceded the point about the linkage of ambient PM/SOAs to gasoline aromatics. However, one of your statements is very concerning: "Since Congress established section 202(l) in the Clean Air Act Amendments of 1990, the net result of the EPA regulations and market shifts has been a reduction in gasoline benzene levels by roughly two thirds and aromatics levels by roughly one third...In addition, the vehicle emission standards have been reduced through three separate rounds of rulemaking...such that the VOC emission rate of today's vehicles is more than 90% lower than in 1990. In combination, these fuel and vehicle standards have already dramatically reduced air toxics emissions." (Emphasis supplied)

We strongly disagree with this assertion. In fact, we believe it is a major distortion of the facts. Best available science, and your Agency's own admissions, proves that EPA models are defective, and that they are substantially under predicting the most potent SOA-bound toxics. To make matters worse, best available science confirms that as vehicle advances such as direct injection engines come to dominate the U.S. light-duty fleet, the most dangerous emissions will get worse, not better.

EPA Has Admitted Its Models Are Defective and Fail to Predict SOA/PAH Emissions. The EPA 2015 UFP Workshop—organized by OTAQ and ORD—conceded that “SOAs play an important role in air quality”, but that EPA's atmospheric models were “not able to predict SOA formation”. [Link to workshop materials [<https://sites.google.com/site/2015ufpworkshop/home>] EPA's principal PM/SOA model is the Community Multi-Scale Air Quality (CMAQ) model, and the MOVES Model relies heavily on its methodology and findings. EPA has admitted that this model significantly under predicts SOA/fine particulates since its 2011 report to Congress on the Clean Air Act's costs and benefits.

At the 2015 UFP Workshop, EPA stated that the new science represented a breakthrough in the investigation of SOA properties, which “play an important role in air quality but for many years available atmospheric models were not able to predict SOA formation. The main issue was the fact that all models relied on the assumptions that SOA particles were well-mixed low viscosity solutions and maintained equilibrium with the gas-phase by rapid mixing in the condensed phase with evaporation and condensation. Recent studies using the multidimensional characterization approach demonstrated that these assumptions were wrong and that SOA particles must be viscous semi-solid. These studies showed also that there is a synergetic effect between PAHs and SOA since PAHs trapped inside SOA particles slow down SOA evaporation and increase SOA yield and lifetime. This can explain the long-range transport of toxic compounds like PAHs and other persistent pollutants. In conclusion, a new SOA paradigm has been developed: particles are semi-solid, nearly non-volatile and trap organic material during formation. The particles are not in equilibrium with the gas phase.” [p. 19 – 20]

It would seem that the “missing SOAs” have been found, and that EPA's models were not reporting them. It is also clear that EPA's working assumption that PAHs dissipate quickly after 300 meters is inoperable—real-time measurements confirm SOA-bound PAHs and BC in urban plumes 30 km from their origination.

Gas-Phase PAHs Preserve Biogenic SOAs and Enable Their Long-Range Transport; Increase Particle Number Concentrations by > Factor of 100. The 2017 Zellenyuk/PNNL et al. study explains why real-time measurement studies have detected large concentrations of SOA-bound PAHs long distances from the point of emission, e.g., up to 30 km, and why they are dominated by gasoline exhaust products. This study (which relies upon the same PNNL multidimensional characterization approach that EPA endorsed at its UFP Workshop) confirms that “when secondary organic aerosol (SOA) particles are formed in the presence of gas-phase polycyclic aromatic hydrocarbons (PAHs), their formation and properties are significantly different from SOA particles formed without PAHs. This is extremely important, because the formation of PAHs and SOAs begins with the incomplete combustion of gasoline aromatics (which modern emission control systems have difficulty in capturing, see Robinson below). SOA particles formed in the presence of PAHs have, as part of their compositions, trapped unreacted PAHs and products of heterogeneous reactions between PAHs and ozone. Compared to ‘pure’ SOA particles, these particles exhibit slower evaporation kinetics, have higher fractions of non-volatile components, like oligomers, and higher viscosities, assuring their longer atmospheric lifetimes. In turn, the increased viscosity and decreased volatility provide a shield that protects PAHs from chemical degradation and evaporation, allowing for the long-range transport of these toxic pollutants. The magnitude of the effect

of PAHs on SOA formation is surprisingly large. The presence of PAHs during SOA formation increases mass loadings by factors of two to five, and particle number concentrations, in some cases, by more than a factor of 100. Increases in SOA mass, particle number concentrations, and lifetime have important implications to many atmospheric processes related to climate, weather, visibility, and human health, all of which relate to the interactions between biogenic SOA and anthropogenic PAHs". The literature also includes EPA studies (Carlton/Bhave et al.) that confirm this synergy between anthropogenic and biogenic SOA formation in urban areas.

Link to Zelenyuk et al.: [The effect of gas-phase polycyclic aromatic hydrocarbons
...<https://pubs.rsc.org/en/content/articlelanding/2017/fd/c7fd00032d>

When secondary organic aerosol (SOA) particles are formed by ozonolysis in the presence of gas-phase polycyclic aromatic hydrocarbons (PAHs), their formation and properties are significantly different from SOA particles formed without PAHs.]

Robinson/Carnegie Mellon Faults MOVES 2014 for Unspeciated SOA Under predictions. Dr. Allen Robinson/Carnegie Mellon has frequently criticized EPA's MOVES 2014 model for its gaps between speciated and total emissions (acknowledged by EPA itself in I. above). "I am concerned about the gap between speciated and total emissions. The standard approach (adopted here), assumes that the unspeciated portion of the NMOG behaves the same as the speciated. This likely is not the case when it comes to secondary organic aerosol (SOA) formation. The unspeciated emissions are likely a complex mixture of higher molecular weight species—these species contribute disproportionately to SOA formation relative to lighter species (e.g., propane)." [P. 65 of attached EPA document: "Speciation of Total Organic Gas and Particulate Matter Emissions from On-Road Vehicles in MOVES2014".]

Robinson's blunt criticism of EPA's MOVES Model is consistent with several Robinson et al. studies found in the literature. For example, see excerpts from the August 2014 Robinson – Maricq SOA study (which warns that newer vehicles are likely to produce even MORE SOAs than older vehicles, in part due to direct injection engines' tendency to increase PAH/BC emissions):

"Over the time scale of these experiments, the mixture of organic vapors emitted by newer vehicles appear to be more efficient (higher yielding) in producing SOA than the emissions from older vehicles. About 30% of the non-methane organic gas emissions from the new vehicles could not be speciated, and the majority of the SOA formed from these vehicles appears to be associated with these unspeciated organics." (Emphasis added)

23176: "Numerous reports have shown that the secondary fraction of fine organic PM (secondary organic aerosol, SOA) dominates primary organic aerosol (POA), even in urban areas with substantial fresh PO emissions...However, chemical transport models systematically under predict SOA levels...Motor vehicle emissions contribute to both POA and SOA concentrations."

"Unspeciated NMOG emissions are not typically included in models and inventories."

"Although tightening regulations have significantly reduced emissions of regulated primary pollutants (for example, Fig. 2 highlights the dramatic reductions in NMOG emissions...), the same may not be true for PM. In fact, Fig. 8 suggests that for LDGVs manufactured over the last twenty years...there may not have been much reduction in their contribution to ambient PM. This is not surprising...changes to engine control/after treatment from LEV1 to LEV2 were not aimed at reducing PM (or the non-volatile particles – EC)."

23197: "Catalysts are optimized to reduce emissions of regulated pollutants (NO_x, NMOG, and CO), not SOA precursors."

23198: "...in the United States there are substantially more LDGVs than HDDVs."

23199: "...SOA production could not be fully explained by speciated (traditional) SOA precursors. However, about 30% of the NMOG emissions from LEV1 and LEV2 vehicles could not be speciated. These unspeciated emissions appear to be important SOA precursors, likely forming the majority of the SOA in experiments performed with LEV1 and LEV2 vehicles. Given the unexpected finding that the gas-phase emissions from newer, LEV2 vehicles are more efficient at producing SOA than emissions from older, pre-LEV vehicles, future studies elucidating the nature of these precursors are needed to advance the development of next-generation SOA models and emission control strategies." (Emphasis added)

<http://www.atmos-chem-phys-discuss.net/13/23173/2013/acpd-13-23173-2013-print.pdf>

Mr. Grundler, for all these reasons, we strongly disagree with your statements that "...these fuel and vehicle standards have already dramatically reduced air toxics emissions", and that "the VOC emission rate of today's vehicles is more than 90% lower than in 1990". We are confident that EPA's models are simply not reporting enormous quantities of SOA-bound PAHs and BC, which are the most toxic, mutagenic endocrine disruptor compounds in the urban environment.

Even more worrisome: unless EPA does its job under section 202(l), these extremely harmful emissions will only get worse as automakers rapidly transition to direct injection engines.

At some point, we would like to visit with you more about these critically important issues. We also respectfully urge you to give serious consideration to the answer we gave to your SAFE Rule comments question: "We strongly believe that the 'ideal octane level' to optimize LDV performance fuel efficiency and reduce harmful emissions and consumer costs is 98 – 100 RON produced with E30+ "clean octane". In fact, we believe it is the only legally permissible way to make high octane fuels 'consistent with Title II of the Clean Air Act'".

Thank you once again, Mr. Grundler, for your consideration, accessibility, and careful attention to these extremely important issues. You will be hearing from us again soon.

Respectfully,



Doug Sombke

President, South Dakota Farmers Union

Cc: Senator Mike Rounds, Environment and Public Works Committee